



Coal Combustion Inc.
Understanding the business of coal

Coal Quality and Combustion Workshop Including Stokers and Cyclones

Class Outline

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Boiler Basics

Coal Formation

What is Coal -
Coal Rank

Coal Mining

Surface
Deep
Out of seam dilution
Coal Washing
Drying coal

Transportation Impacts

Time and Climate
Barge Coal tends to gain moisture

Sampling coal and coal analyses

Sampling methods

The Good, The Bad and the Ugly
Good sampling is hard work

ISO, ASTM Sampling

Guidelines

Hand samples
Feeder and belt
Car top
Mechanical Sampling
Sampling systems
Augers

Core holes

Terms

Proximate . Moisture, ash, volatile, fixed carbon (by difference)

Short Prox . Moisture, ash, sulfur, Btu/lb

Ultimate . Moisture, ash, sulfur, + carbon, hydrogen, nitrogen,
oxygen (by difference)

Coal Cost

Sold by the ton - \$/ton

Boilers want Calorific Value not tons

Evaluated by the Kcal or millions of Kcal (MMcal.)

Coal Handling

Moisture plays a dominant role

Fines

What sizes are important?

Clays and mineral matter

Chemical additives

Spontaneous Combustion

Combustion

The three Ts in practice

Size the coal and add air!

Coal Reactivity

The Story of NOX

To minimize the formation of NOx

Post Combustion Control

Stoker Fired Boilers

Coal Types

Sizing
Sizing Issues
Air Flows
Overfire Air
Bottom Ash Analyses
Fly Ash

Pulverizers

Coal properties
Coal fineness
Measurement Surface moisture HGI Coal size Heating value

Combustion Process

Coal Rank
Air to fuel ratios
Balancing furnaces
Balancing burners
NOx formation
CO analysis

Boiler Efficiency

Boiler efficiency vs. excess oxygen
Moisture and hydrogen impacts
Higher vs. Lower heating value

Ash Deposits - Introduction

Types of Ash Deposits

Wall Slag
Superheater Slag
Convection Pass Fouling
Low Temperature Deposits

Causes of Ash Deposits

Fuel Related
Equipment Related

Design Related

Analytical Procedures

The ASTM Fusion Temperature Test.

Ash levels

Slagging and fouling indices.

Elemental loading

Pounds of iron per million Btu

Pounds calcium, sodium, and other elements

Slagging with Bituminous Type Ash - High Iron

Ash fusion temperatures

Advanced ash fusion techniques.

Ash Chemistry

Base to acid ratio

Slagging index

Dry sulfur x B/A

Iron squared term

Calcium and sodium make these coals higher fouling

Computer Controlled Scanning Electron Microscopy provide some of the best mineralogical information but has not come into common use.

Fouling Deposits

Chemical Fractionation

Active alkali

Water soluble

Ammonium Acetate soluble

Weak acid soluble

Micro crystals

Cyclone and Wet Bottom Furnaces

T-250 and slag viscosity

Proper combustion parameters for PRB coal in cyclones

Deposit Analyses

Electrostatic Precipitator

ESP Operation

Equipment

Airheaters pluggage and leakage

Resistivity

Opacity

Trace Elements

Coal Specifications

Computerized Evaluations

Test Burns

Online Coal Analyzers

Conclusion